

Unit 6

Algebraic Expression Parts

$$2x + 3$$

Variable	Term
Constant	Coefficient

$$5 + 3x$$

Variable	Term
Constant	Coefficient

$$5y - 2x + 9$$

Variable	Term
Constant	Coefficient

$$\frac{x}{3} + 12 - 4y$$

Variable	Term
Constant	Coefficient

Define the following

- 1) Variable
- 2) Term
- 3) Constant
- 4) Coefficient

Write an algebraic expression that contains....

- 3 terms, 2 variables, 2 coefficients and 1 constant
- Label each part of your expression

Can a number be both a constant and a term?

Can a constant change values?

Can a number be both a coefficient and part of a term?

Does an algebraic expression have to include a constant?

Use the algebraic expressions below, label each of the vocabulary words listed. You may have more than one of each or none for some words.

a) $7 + x - 7y$

Coefficient _____ Term _____ Variable _____ Constant _____

b) $9 + x$

Coefficient _____ Term _____ Variable _____ Constant _____

c) $15 + 8x + 9m$

Coefficient _____ Term _____ Variable _____ Constant _____

d) $6a + 21b + 14c$

Coefficient _____ Term _____ Variable _____ Constant _____

e) $3g - 2 + 11x^2$

Coefficient _____ Term _____ Variable _____ Constant _____

f) $13 + x + 8d$

Coefficient _____ Term _____ Variable _____ Constant _____

Match the vocabulary to the correct definition.

_____ 1. Algebraic expression

_____ 2. Coefficient

_____ 3. Constant

_____ 4. Term

_____ 5. Variable

- a) Each part of an expression separated by an operation
- b) A number that stands by itself
- c) A number that does not stand by itself; it is attached to a variable
- d) A letter that stands for a particular numerical value
- e) A mathematical phrase that can contain numbers, variables and operation symbols.

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Identify each part of the algebraic expression as the coefficient, constant or variable.

1)  $4x - 12$

- a) 4 is a(n) \_\_\_\_\_
- b) X is a(n) \_\_\_\_\_
- c) What is the constant? \_\_\_\_\_
- d) How many terms are there? \_\_\_\_\_

2)  $8 + a + 3b$

- a) A is a(n) \_\_\_\_\_

- b) 3 is a(n) \_\_\_\_\_
- c) B is a(n) \_\_\_\_\_
- d) What is the constant? \_\_\_\_\_
- e) How many terms are there? \_\_\_\_\_

### Property Notes

|                                                                                                                                                                                                          |                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p style="text-align: center;"><b>Commutative Property of Addition and Multiplication</b></p> <p>Definition:</p><br><br><br><p>Example (of addition):</p><br><br><br><p>Example (of multiplication):</p> | <p style="text-align: center;"><b>Associative Property of Addition and Multiplication</b></p> <p>Definition:</p><br><br><br><p>Example (of addition):</p><br><br><br><p>Example (of multiplication):</p> |
| <p style="text-align: center;"><b>Identity Property of Zero</b></p> <p>Definition:</p><br><br><br><p>Example (of addition):</p>                                                                          | <p style="text-align: center;"><b>Identity Property of One</b></p> <p>Definition:</p><br><br><br><p>Example</p>                                                                                          |

|                              |         |
|------------------------------|---------|
| Example (of multiplication): | Example |
|------------------------------|---------|

### Property Matching

Using the properties listed below, match each example with the correct property.

- A) Associative property of addition
- B) Associative property of multiplication
- C) Commutative property of addition
- D) Commutative property of multiplication
- E) Identity property of zero
- F) Identity property of one

|                         |                                               |                           |                           |
|-------------------------|-----------------------------------------------|---------------------------|---------------------------|
| $2 \cdot x = x \cdot 2$ | $(9 \cdot y) \cdot 10 = 9 \cdot (y \cdot 10)$ | $0 + 56 = 56$             | $1 \cdot 75 = 75$         |
| $a(bc) = (ab)c$         | $2 + a + b = b + a + 2$                       | $25 + 62 = 62 + 25$       | $5 \cdot 1 = 5$           |
| $ab = ba$               | $(1+2) + 3 = 1 + (2+3)$                       | $7 \cdot 22 = 22 \cdot 7$ | $103 + 0 = 103$           |
| $6 \cdot 0 = 0$         | $8 \cdot 2 \cdot 10 = 10 \cdot 8 \cdot 2$     | $a + 0 = a$               | $3 + (5+7) = (3 + 5) + 7$ |

Complete the equation to represent each property

- 1) Associative property of multiplication

$$9 ( 7 \cdot 8 ) = \underline{\hspace{2cm}}$$

- 2) Identity property of zero

$$8 + \underline{\hspace{1cm}} = 8$$

3) Commutative property of addition

$$12 + 90 = \underline{\hspace{2cm}}$$

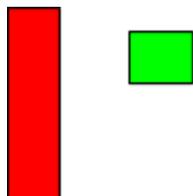
4) Associative property of addition

$$8 + (7 + 12) = \underline{\hspace{2cm}}$$

5) Commutative property of multiplication

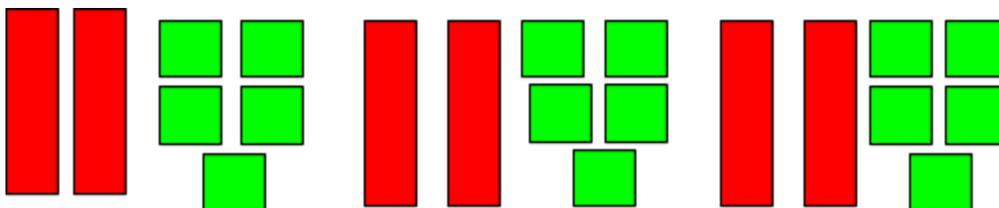
$$34 \cdot 54 = \underline{\hspace{2cm}}$$

### Distributive Property-using models



Use algebra tiles to multiply and model  $3(2x + 5)$ . Each red bar represents  $x$  and each green square represents 1.

The 3 represents/stands for “3 groups of  $2x + 5$ ”



Now group the like tiles (draw a picture to represent)

So when you simplify  $3(2x + 5) = \underline{\hspace{2cm}}$

### Practice

Model and simplify the expressions using algebra tiles.

1)  $3(x + 4) = \underline{\hspace{2cm}}$

2)  $2(x + 5) = \underline{\hspace{2cm}}$

$$3) 2(2x + 2) = \underline{\hspace{2cm}} \qquad 4) 3(3x + 1) = \underline{\hspace{2cm}}$$

**Distributive Property-Model and Simplify each expression**

$$1) 4(x + 1) = \underline{\hspace{2cm}} \qquad 2) 2(2x + 3) = \underline{\hspace{2cm}}$$

$$3) 5(x + 2) = \underline{\hspace{2cm}} \qquad 4) 3(3x + 2) = \underline{\hspace{2cm}}$$

**Define Distributive Property:**



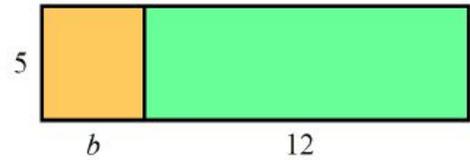
To understand even better why the distributive property works, let's look at an area model (this, too, you have seen before!).

The area of the whole rectangle is 5 times  $(b + 12)$ .

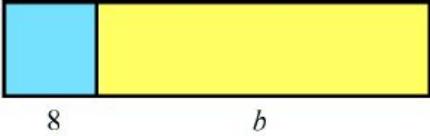
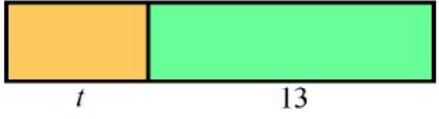
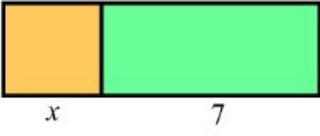
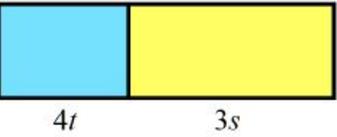
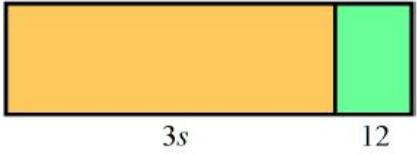
But, if we think of it as *two* rectangles, the area of the first rectangle is  $5b$ , and of the second,  $5 \cdot 12$ .

Of course, these two expressions have to be equal:

$$5 \cdot (b + 12) = 5b + 5 \cdot 12 = 5b + 60$$



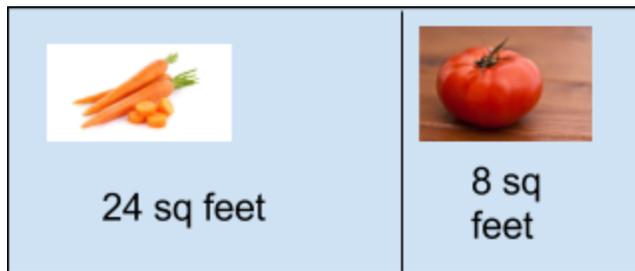
4. Write an expression for the area in two ways, thinking of one rectangle or two.

|                                                                                                                                                                                                                                |                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>a. <math>9(\underline{\quad} + \underline{\quad})</math> and<br/><math>9 \cdot \underline{\quad} + 9 \cdot \underline{\quad} =</math></p> |  <p>b. <math>s(\underline{\quad} + \underline{\quad})</math> and<br/><math>s \cdot \underline{\quad} + s \cdot \underline{\quad} =</math></p> |
|  <p>c. <math>\underline{\quad}(\underline{\quad} + \underline{\quad})</math> and</p>                                                         |  <p>d.</p>                                                                                                                                   |
|  <p>e.</p>                                                                                                                                  |  <p>f.</p>                                                                                                                                  |

### Distributive Property

Mary planted carrots and tomatoes in her garden just like the picture below.

What are the possible dimensions (length/width) of her entire garden?



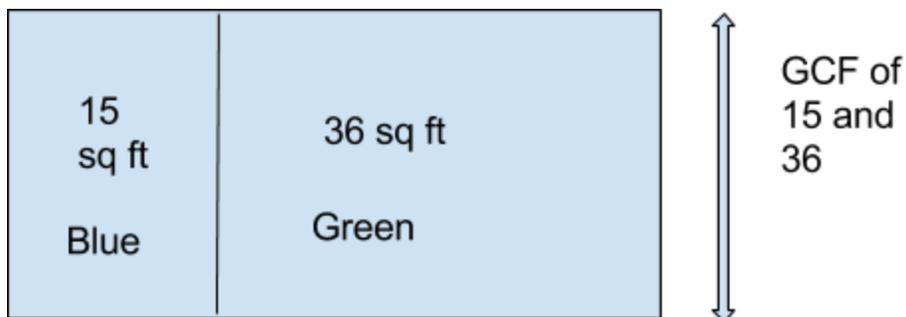
List your possibilities:

24:

8:

What set of dimensions has the GCF of 24 and 8? (This would be the width of the rectangle) \_\_\_\_\_

The wall of the gymnasium was painted in 2 different colors as shown in the diagram below. What are the dimensions of the wall if the height of the wall is equal to the GCF of 36 and 15?



## Working Backwards with the Distributive Property

Re-write the sum of  $30 + 14$  by factoring out the GCF and using the distributive property.

Factors pairs of 30:

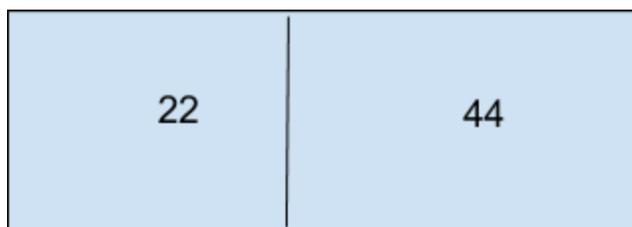
Factor pairs of 14:



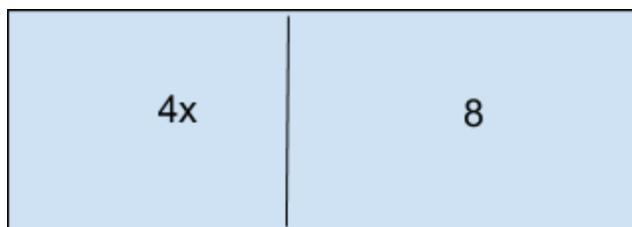
Re-write the sum of  $22 + 44$  by factoring out the GCF and using the distributive property.

Factor pairs of 22:

Factor pairs of 44:



Re-write the sum of  $4x + 8$  using the distributive property.



What does the number on the outside of the parentheses mean? \_\_\_\_\_

What does the information in the parentheses mean? \_\_\_\_\_

## Using the Distributive Property

Use the GCF and distributive property to rewrite each sum.

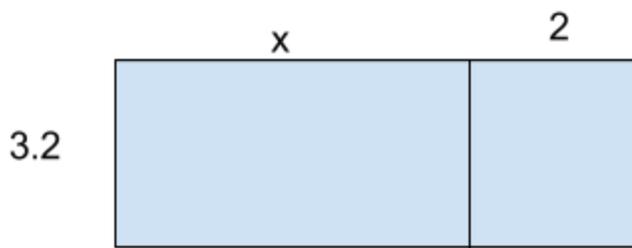
1)  $30 + 8$

2)  $18 + 24$

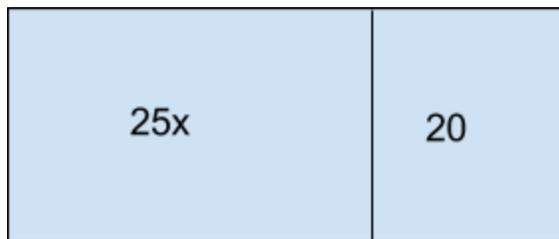
3)  $20 + 15$

4)  $90 + 72$

5) Represent the area below as an expression.



6) Find the length and width of the figure below. Use the GCF



Rewrite each expression using the distributive property

7)  $5(4x + 6)$

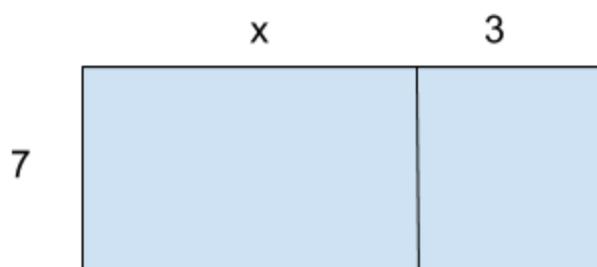
8)  $6(c + 4)$

Use the distributive property to represent the area model. Write the expression and then simplify.

9)

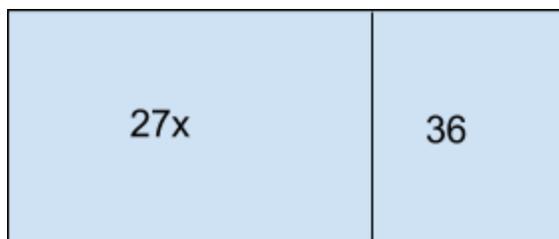


10)

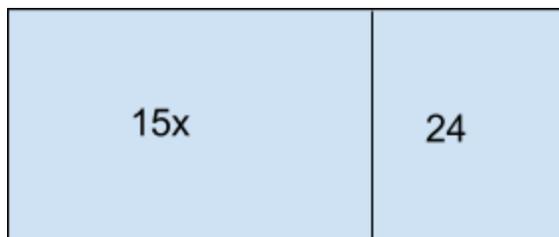


Find the GCF to create an equivalent expression

11)



12)



## Combine Like Terms

### Organizing Your Closet

Your mom is very upset with you because your closet is a total disaster. She's telling you that you will not attend the school dance unless you have your closet organized.

- 1) Using the pictures you have cut out of a magazine, organize them into 3-5 categories.
- 2) Explain what your rule is for sorting items in the closet.
- 3) Assign a variable to each category and write a mathematical expression to describe your closet.
- 4) Explain why you cannot combine different categories.
- 5) You are now given a basket full of clean clothes/items. Using the rule you have developed, sort the clothes and add them to the items in your closet.
- 6) The following are the average cost of clothes/items. Using the dollar amount of the clothes/items evaluate the total value of your closet.

|       |        |       |      |       |       |         |       |
|-------|--------|-------|------|-------|-------|---------|-------|
| shoes | shirts | pants | hats | belts | misc. | jackets | dress |
| \$45  | \$25   | \$35  | \$15 | \$10  | \$5   | \$20    | \$30  |

In this activity, you have used the math skill of combining like terms (variables). Apply what you have learned to simplify the following mathematical expressions.

7)  $a + a + a + b + b + c + a + b$

8)  $2a + b + 3c + 4a + c$

## Simplify Algebraic expressions-ADDITION

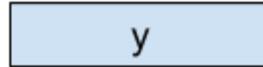
Model each expression. Rewrite in simplest terms.



Green



Red



Yellow

1)  $2x + 4 + x + 1 =$

2)  $2y + 5 + y + 4x + 2x =$

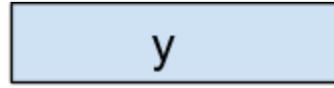
3)  $4x + 6 - x - 3 =$

4)  $3y + 6 + 4x - 2y + 3 =$

Write a general rule for **HOW TO ADD ALGEBRAIC EXPRESSIONS**

**Simplify Algebraic Expressions: MULTIPLICATION**

Red



Yellow

Model each expression. Rewrite in simplest terms.

1)  $3(2x) =$

2)  $2 \cdot 5y =$

3)  $4 \cdot 3x =$

4)  $3(6y) =$

Write a general rule for **HOW TO MULTIPLY ALGEBRAIC EXPRESSIONS**

## Combine Like Terms

Simplify each expression by combining like terms.

Strategy:

- underline or highlight using a different color for different terms
- rewrite like terms together
- simplify the expression

1)  $6 + z + 4z + 9 + 8u$

2)  $2x + 8z + 3w + 6z + 4w$

3)  $4y + 3x - 2y + 9x + 4$

4)  $5x + 8 + 3y + 2x + 8y$

5)  $2p + 8 + k - 7$

6)  $3k + d - k + 7d$

7)  $1 + 8x + 3y + x + 9y$

8)  $4x + 5x + 5x + 10x$

## Translating Algebraic Expressions

| Operation | Verbal expression                      | Algebraic expression |
|-----------|----------------------------------------|----------------------|
| <b>+</b>  | The sum of a number and 7              |                      |
|           | 6 more than a number                   |                      |
|           | 3 plus 8                               |                      |
|           | 24 added to a number                   |                      |
|           | A number increased by 5                |                      |
| <b>-</b>  | The difference of a number and 12      |                      |
|           | 2 less than a number                   |                      |
|           | 12 minus a number                      |                      |
|           | A number decreased by 12               |                      |
|           | A number less than 12                  |                      |
|           | A number subtracted from 10            |                      |
| <b>X</b>  | 16 times a number                      |                      |
|           | Some number multiplied by 6            |                      |
|           | Twice a number                         |                      |
|           | The product of two numbers             |                      |
| <b>÷</b>  | The quotient of 8 and some number      |                      |
|           | A number divided by 13                 |                      |
|           | 12 increased by 5 times a number       |                      |
|           | The product of k and 4 increased by 13 |                      |
|           | The quotient of 4 and h                |                      |

|  |                |  |
|--|----------------|--|
|  | increased by 9 |  |
|--|----------------|--|

## Translating Algebraic expressions

Write an algebraic expressions for each phrase

- 1) The sum of a number and thirty-seven \_\_\_\_\_
- 2) The quotient of sixty-one and a number \_\_\_\_\_
- 3) A number increased by ninety-three \_\_\_\_\_
- 4) The product of thirty-two and a number \_\_\_\_\_
- 5) The product of twenty-five and a number \_\_\_\_\_
- 6) The difference between a number and eight \_\_\_\_\_
- 7) Nine more than a number \_\_\_\_\_
- 8) fifty -nine times a number \_\_\_\_\_
- 9) The quotient of a number and ninety-seven \_\_\_\_\_
- 10) Seventeen times a number \_\_\_\_\_
- 11) A number decreased by eighty-six \_\_\_\_\_
- 12) The sum of sixty-one and a number \_\_\_\_\_
- 13) The difference between ninety and a number \_\_\_\_\_
- 14) Eighty-one less than a number \_\_\_\_\_

**Practice:**

Underline the part of the phrase that indicates the main operation, then write an expression.

- 1) Eight more than a number \_\_\_\_\_
- 2) Eleven decreased by a number \_\_\_\_\_
- 3) Four less than six times a number \_\_\_\_\_
- 4) The sum of a number and nine \_\_\_\_\_
- 5) The product of a number and seventeen \_\_\_\_\_
- 6) Fifty divided by the sum of a number and ten \_\_\_\_\_

Write an algebraic expression to represent each real world situation.

- 1) There were 21 passengers on a bus. At the next stop,  $p$  passengers got off the bus. Write an expression to represent how many passengers are on the bus now.  
\_\_\_\_\_
- 2) Traci's age is 5 years less than her sister's age,  $a$ . Write an expression to represent how old Traci is. \_\_\_\_\_
- 3) Betty divided 90 stickers equally among  $f$  friends. How many stickers will each friend receive? \_\_\_\_\_
- 4) Bill and Jeremy both collected model cars. Bill has 3 times as many model cars as Jeremy has,  $j$ . Write an expression to represent how many model cars Bill has. \_\_\_\_\_
- 5) Ramel has read 10 more comic books than Cameron. Cameron has read  $b$ , comic books. Write an expression to represent how many comic books Ramel has read. \_\_\_\_\_

### Evaluating Expression (Substitution)

To evaluate an expression with one or more variables, substitute the given number(s) for the variable(s). Then follow the order of operations to simplify the expression.

Ex) evaluate  $n + 24$  when  $n = 18$

Substitute 18 for  $n$

$$18 + 24 = 42$$

Practice:

Evaluate each expression when  $y = 3$  and  $z = 6$

1)  $15 + z$

2)  $4 + (z + 10)$

3)  $11 + (y \cdot 3)$

4)  $30 + z$

5)  $(18 - z) \div 4$

6)  $y \div 3 + z$

For numbers 7-12 evaluate each expression when  $a = 5$ ,  $b = 2$  and  $c = 4$

7)  $4c \div 8$

8)  $25 + a$

9)  $3a - 7$

10)  $(b + 9) \cdot 5$

11)  $100 \div (3 - b)$

12)  $13c + 23$

**Writing Algebraic Expressions to solve problems.**

**Going Bowling**

**For each scenario: 1-write the expression in words 2- plug in the numbers 3-solve for an answer.**

- 1) You and your friends are going bowling. It costs \$2.50 to rent shoes and it costs \$3.50 to bowl one game.
  - a) How much will it cost you to rent shoes and bowl 1 game?
  
  - b) How much will it cost you to rent shoes and bowl 2 games?
  
  - c) How much will it cost you to rent shoes and bowl 3 game?
  
- 2) Describe how you calculated the total cost for each situation.
  
  
- 3) What are the variable quantities in this problem?
  
  
- 4) What are the constant quantities in this problem?
  
  
- 5) What variable quantity depends on the other variable quantity?
  
  
- 6) Write an algebraic expression to determine the total cost to rent shoes and bowl games. Let  $g$  represent the unknown number of games bowled.

### Restaurant

A local restaurant is busiest over lunch and has three cooks who work at this time. The cooks divide the incoming orders among themselves. So far today, the cooks have prepared 21 meals total.

- a) If an additional 18 orders come in, how many meals will each cook prepare? Write an expression and show your calculations.
  
- a) If 42 additional orders come in, how many meals will each cook prepare? Write an expression and show your calculations.
  
- b) What is the variable in this problem? What is the constant?
  
- c) Write an expression to represent the unknown number of meals each cook prepares. Let  $m$  represent the number of additional orders.

### Fundraiser

Christopher is selling oatmeal energy bars to raise money for his baseball team. The team receives \$1.25 for each oatmeal energy bar sold. He has already sold 25 oatmeal energy bars.

- a) If Christopher sells 10 more energy bars, how much money will he raise for the baseball team? Write an expression and show your calculations.
  
- b) If Christopher sells 45 more energy bars, how much money will be raised for the baseball team? Write an expression and show your calculations.
  
- c) What is the variable in this problem? What is the constant?

- d) Write an expression to represent the unknown amount of money Christopher will raise for his baseball team. Let  $c$  represent the number of additional energy bars sold.

### Ice Cream

You have decided to treat yourself and two friends to ice cream. Now you need to decide if you are going to “Scoops” Ice cream shop or “Cold Treats” ice cream shop.

a)

“Scoops” has one cone of ice cream for \$3.00 and each topping is \$1.00

*Write an expression in words for “Scoops”*

---

Write the expression using “ $x$ ” for number of cones and “ $y$ ” for the number of toppings

---

“Cold Treats” has one cone of ice cream for \$2.00 and each topping is \$1.50.

*Write an expression in words for “Cold Treats”*

---

Write the expression using “ $x$ ” for number of cones and “ $y$ ” for the number of toppings

---

- b) If you and your two friends all want to get an ice cream cone and 3 toppings each, which shop would be the least expensive? Show your work

“Scoops” \_\_\_\_\_

“Cold Treats” \_\_\_\_\_

### Perimeter

The formula for the perimeter of a rectangle is  $P = 2l + 2w$ . The length of a rectangle is 5 units longer than the width. Write an algebraic expression that can be used to find the perimeter of the rectangle.

What is the perimeter of the rectangle above if the length is 12cm?